TPM

User's Guide

Revision 1.0a

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Preface

About This User's Guide

This user's guide is written for system integrators, IT professionals, and knowledgeable end users who wish to add additional data security levels to their systems to protect highly sensitive applications. It provides detailed information on configuring, provisioning, and using the trusted platform module (TPM).

User's Guide Organization

Chapter 1 provides an overview of the trusted platform module (TPM), including its features and uses.

Chapter 2 provides detailed instructions on installing, provisioning, and using the TPM.

Conventions Used in This User's Guide

Pay special attention to the following symbols for proper TPM configuration.

Warning: Important information given to avoid TPM configuration errors.

Note: Additional information given to ensure correct TPM configuration setup.

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Chapter 1

Introduction

1.1 Overview of the Trusted Platform Module (TPM)

The Trusted Platform Module (TPM) is a special add-on module that may be installed onto most Supermicro X9, all Supermicro X10, and some Supermicro AMD motherboards. It holds computer-generated encryption keys used to bind and authenticate input and output data passing through a system.

A. Types of TPMs

Supermicro makes available two lines of TPMs, each of them divided into four distinct products.

> **Note:** Currently, all TPMs must be provisioned before they can be used. Contact Supermicro technical support to get the Intel® Provisioning Utility.

The **TPM-9655 series** uses TCG (Trusted Computing Group) version 1.2 firmware, which is the most commonly supported.

The following SKUs are available:

- AOM-TPM-9655V-S, a vertical server-side TPM
- AOM-TPM-9655H-S, a horizontal server-side TPM
- AOM-TPM-9655V-C, a vertical client-side TPM
- AOM-TPM-9655H-C, a horizontal client-side TPM

Horizontal vs. Vertical: Generally, whether you should use a TPM with a horizontal or vertical form factor depends on the physical space available. Horizontal TPMs are used in 1U chassis. Vertical TPMs are used in 2U or taller chassis heights; they are also designed with a smaller footprint to occupy less space on the motherboard.

Server-Side vs. Client-Side: Each TPM is predesignated as a server-side or a client-side TPM. Be sure to use the appropriate TPM for your needs. The server-side TPM is designed to run on Intel Xeon® E5 and E7 processors. It has a 96-byte memory. The client-side TPM is designed to run on Intel Core™ i5, Core i7, and Xeon E3 processors. It has a 48-byte index memory.

1.2 Supermicro TPM Features

1. TCG 1.2 compliance

2. Microcontroller in 0.22/0.09-µm CMOS technology

3. Compliant embedded software

4. EEPROM for TCG firmware enhancements and for user data and keys

5. Hardware accelerator for SHA-1 and SHA-256 hash algorithm

6. True Random Number Generator (TRNG)

7. Tick counter with tamper detection

8. Protection against dictionary attack

9. Infineon's TPM 1.2 is Common Criteria certified at Evaluation Assurance Level (EAL) 4 Moderate

10. General-purpose I/O

11. Intel® Trusted Execution Technology (TXT) support

12. AMD® Secure Virtual Machine Architecture support

13. Full personalization with Endorsement Key (EK) and EK certificate

14. Power-saving sleep mode

15. 3.3V power supply

16. WHQL dual-mode 1.1b + 1.2 TPM Windows Kernel Mode Driver

1.3 Intel® TXT

The Intel TXT is a software tool that may be used in conjunction with the TPM to provide additional security for pre-launch firmware of clusters and clouds, including the BIOS, IPMI, SAS firmware, CMM firmware, and more. It is optional, but the TPM is required for it to be provisioned. It further increases system security by protecting firmware against malicious attacks to vulnerable areas.

It works by matching hypervisor measures with encryption keys upon system launch. If the hypervisor does not match the keys, then the hypervisor will be prevented from starting up.

To use the TXT, you need to enable TXT support after provisioning the TPM.

A. How the TXT Works

The Intel TXT, when enabled, follows a step-by-step process to ensure security of pre-launch components.

1. Measures the hypervisor launch upon system startup
2. Checks for a match
3. If matched: The TXT signals "trusted," and the launch is allowed to proceed.
4. If mismatched: The TXT signals "untrusted," and the launch is blocked.

1.4 Motherboards Supported

Please refer to the Supermicro website (http://www.supermicro.com/) for a complete and most up-to-date list of the motherboards that can support the TPM. As a general rule, these are most X9 motherboards, all X10 motherboards, and some AMD motherboards. Such motherboards will have a specially designated JTPM1 connector, which will be listed in the respective motherboard's manual.

1.5 An Important Note to the User

The graphics shown in this user's guide were based on the latest information available at the time of publishing of this guide. The TPM screens shown on your computer may or may not look exactly like the screen shown in this user's guide.

Chapter 2

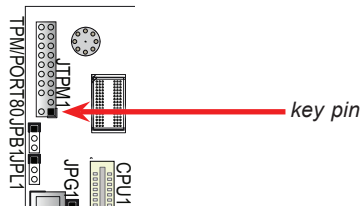
Deploying and Using the TPM

Follow the instructions below to begin using the TPM.

2.1 Installing the TPM Onto the Motherboard

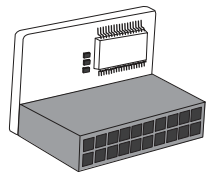
To install the Trusted Platform Module onto your motherboard, follow the steps below.

1. Find the 20-pin male JTPM1 connector on the motherboard. If you need help locating this connector, consult your motherboard manual. If the board does not have this feature, then it does not support the TPM.
2. Using the key pin as a reference, orient and align your TPM with the connector.

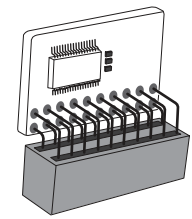


3. Carefully insert the TPM into the connector on the motherboard, taking care not to damage the pins.

Note: The orientation of the TPM to be installed depends on whether it has a horizontal or vertical form factor. The vertical TPM is intended to "stand" perpendicular the motherboard, while the horizontal TPM lies flat (parallel) on the motherboard. See the below two images for the correct orientation.



Horizontal TPM

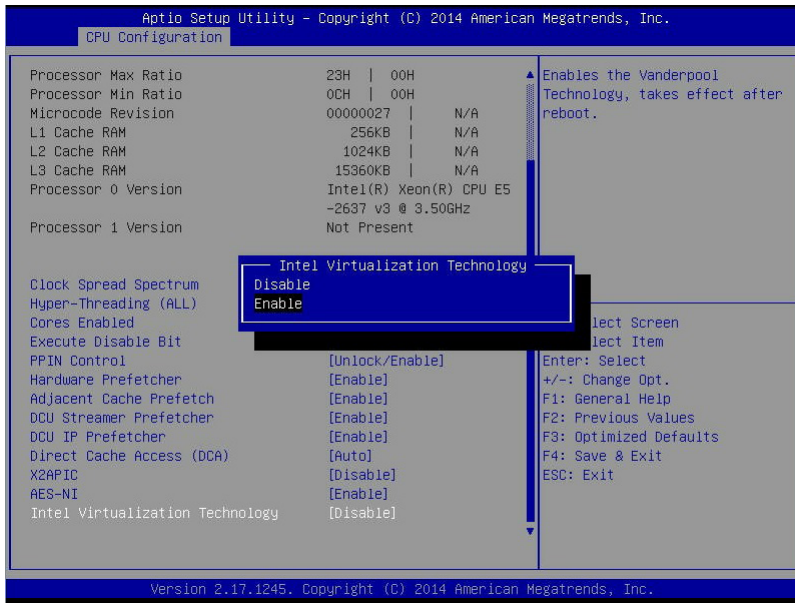


Vertical TPM

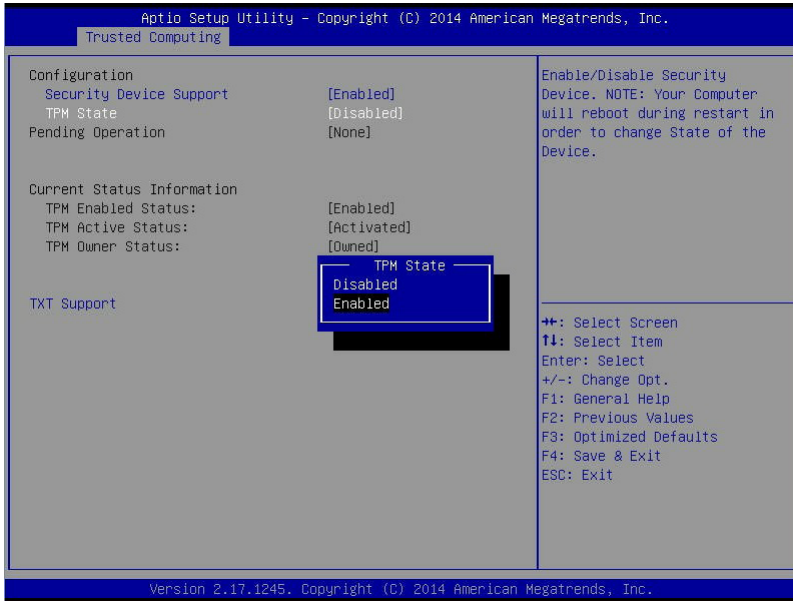
2.2 Enabling TPM in the BIOS

The steps below describe the proper procedure on how to enable the TPM in the BIOS. This process is necessary to activate support in the system before you can start using the TPM.

1. Enter the BIOS setup screen. You may do this either from the IPMI remote console or from the server directly using KVM. Reboot the system, and press the <Del> key as the system boots until you reach the BIOS screen.
2. You will be presented with the BIOS Setup main screen. Using your arrow keys, navigate to the *Advanced* tab. From there, navigate down and select the "CPU Configuration" option, as shown below. Press <Enter>.
3. You will be taken to the CPU Configuration page. Using your arrow keys, navigate down to the "Intel Virtualization Technology" option, and press <Enter>. Select "Enable" and press <Enter>.


Aptio Setup Utility – Copyright (C) 2014 American Megatrends, Inc.
CPU Configuration
Processor Max Ratio 23H | 00H
Processor Min Ratio 0CH | 00H
Microcode Revision 00000027 | N/A
L1 Cache RAM 256KB | N/A
L2 Cache RAM 1024KB | N/A
L3 Cache RAM 15360KB | N/A
Processor 0 Version Intel(R) Xeon(R) CPU E5 -2637 v3 @ 3.50GHz
Processor 1 Version Not Present
Enables the Vanderpool Technology, takes effect after reboot.
Intel Virtualization Technology
Disable
Enable
Clock Spread Spectrum
Hyper-Threading (ALL)
Cores Enabled
Execute Disable Bit
PPIN Control [Unlock/Enable]
Hardware Prefetcher [Enable]
Adjacent Cache Prefetch [Enable]
DCU Streamer Prefetcher [Enable]
DCU IP Prefetcher [Enable]
Direct Cache Access (DCA) [Auto]
X2APIC [Disable]
AES-NI [Enable]
Intel Virtualization Technology [Disable]
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previous Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.17.1245. Copyright (C) 2014 American Megatrends, Inc.

4. Once you have enabled virtualization support, press your <Esc> key until you are back to the *Advanced* tab. Navigate down to the "Trusted Computing" option and press <Enter>.
5. The Trusted Computing window will appear. Select "TPM State," and press <Enter>.
6. From the window that pops up, select "Enabled," as shown on the next page, and press <Enter>.

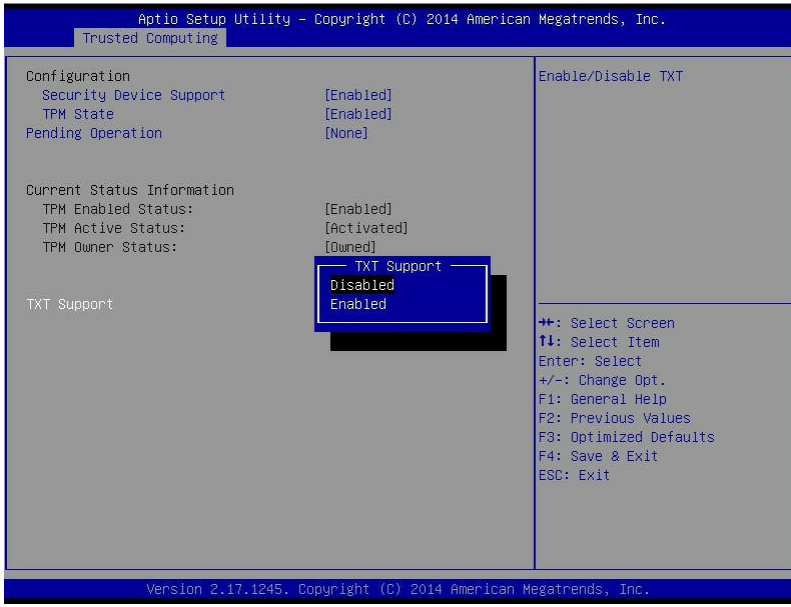


7. You must save your changes and reset for the changes to take effect. Scroll to the *Save & Exit* tab and select "Save Changes and Reset." The TPM is now enabled.

2.3 Setting Up TXT Support

Before you begin using the TXT, you must follow the steps below.

1. Insert the TPM onto the motherboard, enable, and provision it. See the previous sections of chapter 2 for instructions on how to do this.
2. Restart the system and enter the BIOS setup screen.
3. Navigate to the Trusted Computing screen as described in section 2.2, step 2.
4. Select the "TXT Support" item. Press <Enter>. A "TXT Support" window will pop up as shown on the next page.

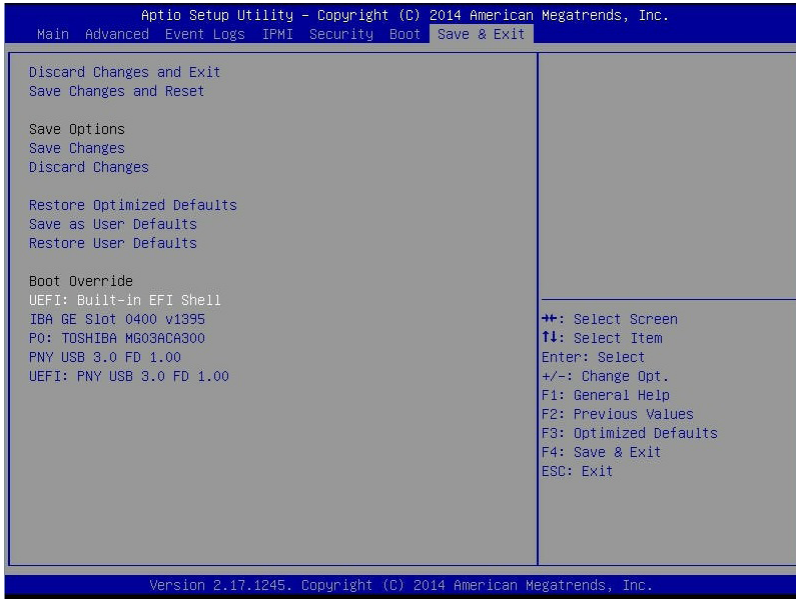


5. Select "Enabled," and press <Enter>.
6. Save changes and reset to save your changes and allow them to take effect. The TXT is now enabled.
7. Use a third-party tool to test the hypervisor launch.

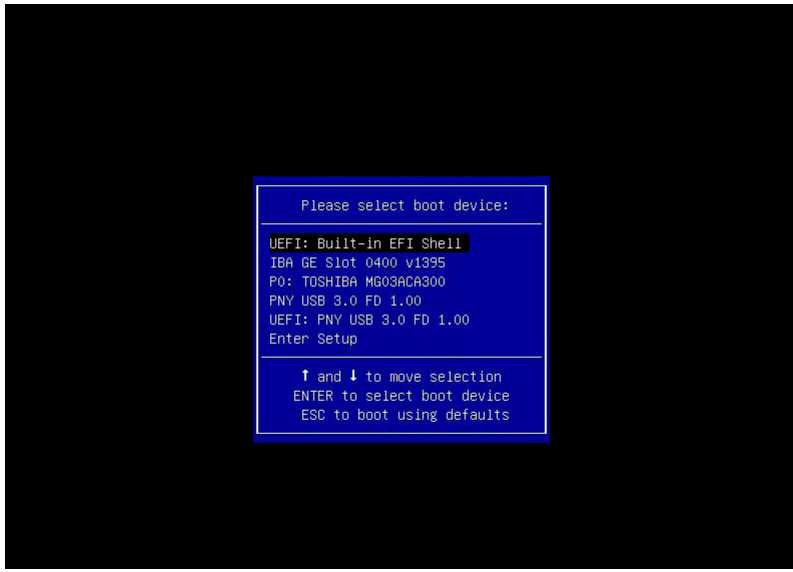
2.4 Intel Provision Utility

To lock the TPM, you must run the Intel Provision Utility.

1. Save a copy of the utility to a USB flash drive, and plug the drive into your sytem. To download the utility, contact Supermicro support.
2. Boot into the UEFI shell. There are two ways you can do this, described below:
   - *Option 1:* From the BIOS, scroll to the *Save & Exit* tab. Select the option "UEFI: Built-in EFI Shell" under *Boot Override*, as shown in the screenshot on the next page. Press <Enter>. If a window pops up that prompts, "Save configuration and reset?" select "Yes" and press <Enter>.


Aptio Setup Utility – Copyright (C) 2014 American Megatrends, Inc.
Main Advanced Event Logs IPMI Security Boot Save & Exit
Discard Changes and Exit
Save Changes and Reset
Save Options
Save Changes
Discard Changes
Restore Optimized Defaults
Save as User Defaults
Restore User Defaults
Boot Override
UEFI: Built-in EFI Shell
IBA GE Slot 0400 v1395
P0: TOSHIBA MG03ACA300
PNY USB 3.0 FD 1.00
UEFI: PNY USB 3.0 FD 1.00
→←: Select Screen
↑↓: Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previous Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.17.1245. Copyright (C) 2014 American Megatrends, Inc.

- *Option 2:* Reboot the system. As the system boots up, press the <F11> key. The following list will appear. Using your arrow keys, select "UEFI: Built-in EFI Shell." Press <Enter>.


Please select boot device:
UEFI: Built-in EFI Shell
IBA GE Slot 0400 v1395
P0: TOSHIBA MG03ACA300
PNY USB 3.0 FD 1.00
UEFI: PNY USB 3.0 FD 1.00
Enter Setup
↑ and ↓ to move selection
ENTER to select boot device
ESC to boot using defaults

3. You are now in the EFI shell. If a line prompts you to press <Esc> to skip *startup.nsh*, do so.Type *map* to find out your USB ID. A list of devices

4. Type *fs0:* to enter the flash drive directory.

```
Shell> fs0:

fs0:\> _
```

5. Type *cd serverTPMTool.*

```
fs0:\> cd serverTPMTool

fs0:\ServerTPMTool> _
```

6. Type *cd Executable*.

```
fs0:\ServerTPMTool> cd Executable

fs0:\ServerTPMTool\Executable> _
```

7. Type *DefaultTPMProvisionNPW-Locked.nsh*.

```
fs0:\ServerTPMTool\Executable> DefaultTPMProvisionNPW-Locked.nsh_
```

8. You should see the screen shown below indicating that the TPM is now locked.

```
Intel(R) TPM Tool x64 DEBUG. Major version:[1] Minor version:[.0] BUILD DATE:[Apr  9 2013].
Definition File Read Complete.
TPM Unlocked
TPM define successful.
DefaultTPMProvisionNPW-Locked.nsh> ServerTPMTool.efi PS-NPW.nvi

Intel(R) TPM Tool x64 DEBUG. Major version:[1] Minor version:[.0] BUILD DATE:[Apr  9 2013].
Data File Read Complete.
TPM Unlocked
TPM write successful.
DefaultTPMProvisionNPW-Locked.nsh> ServerTPMTool.efi PS-WriteProtect.nvi

Intel(R) TPM Tool x64 DEBUG. Major version:[1] Minor version:[.0] BUILD DATE:[Apr  9 2013].
Data File Read Complete.
TPM Unlocked
TPM write successful.
DefaultTPMProvisionNPW-Locked.nsh> ServerTPMTool.efi PPI.nvi

Intel(R) TPM Tool x64 DEBUG. Major version:[1] Minor version:[.0] BUILD DATE:[Apr  9 2013].
Data File Read Complete.
TPM Unlocked
TPM write successful.
DefaultTPMProvisionNPW-Locked.nsh> ServerTPMTool.efi TPM_Lock.def

Intel(R) TPM Tool x64 DEBUG. Major version:[1] Minor version:[.0] BUILD DATE:[Apr  9 2013].
Definition File Read Complete.
TPM Unlocked
TPM define successful.

fs0:\ServerTPMTool\Executable> _
```

9. To check that the TPM has been successfully locked, type *ServerTPMTool.efi.*

```
fs0:\ServerTPMTool\Executable> ServerTPMTool.efi

Intel(R) TPM Tool x64 DEBUG. Major version:[1] Minor version:[.0] BUILD DATE:[Apr  9 2013].
1: Display TPM Status (Version, V-flags, P-flags, etc)
2: NV RAM Functions
3: Lock the TPM
4: Take Ownership
5: Clear Ownership
6: PCR Functions
7: TIS Functions
8: TPM Start Up
9: TPM Continue Self Test
Q: Quit
> 1_
```

10. From the menu that appears, press <1> ("Display TPM Status"), as shown above, and press <Enter>.

11. From the TPM Status Menu that appears, press <3>, and press <Enter>.

```
TPM Status Menu
1: Display TPM Interface Status
2: Display TPM Volatile flags
3: Display TPM Non-Volatile flags
Q: Previous Menu
> 3_
```

12. You should receive an output log. The "nvLocked" item, indicated by the arrow below, should be set to 1. This shows that the TPM has been successfully locked.

```
TPM Status Menu
1: Display TPM Interface Status
2: Display TPM Volatile flags
3: Display TPM Non-Volatile flags
Q: Previous Menu
> 3
  TPM Permanent Flags value:
    disable                     = 0
    ownership                   = 1
    deactivated                 = 0
    readPubek                   = 1
    disableOwnerClear           = 0
    allowMaintenance            = 0
    physicalPresenceLifetimeLock = 0
    physicalPresenceHWEnable    = 0
    physicalPresenceCMDEnable   = 1
    FIPS                        = 0
    enableRevokeEK              = 0
    nvLocked                    = 1
    tpmEstablished              = 0
_
```

13. If you come across any error messages along the way, or if the "nvLocked" item is still set to 0 despite your following the instructions above, try the following troubleshooting tips:

    - Make sure that the CPU you are using is compatible. It should be an Intel® Xeon® E5-2600 C2 or later model.

    Note: AOM-TPM-9655V-S and AOM-TPM-9655H-S are compatible with Xeon E5/E7 processors. AOM-TPM-9655V-C and AOM-TPM-9655H-C are compatible with Intel Core i5/i7 and Xeon E3 processors.

    - Make sure that TXT support is enabled in the BIOS. (See section 2.3.)
    - If the problem persists, contact Supermicro's technical support.

Notes

(Disclaimer Continued)

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